Government of Yukon

Climate Change Strategy

Yukon
Government

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Preface

Climate change is a global issue, presenting challenges all over the world. Most climate scientists have concluded that global temperatures are rising and that warming in the past 50 years has been accelerated by human activities that release greenhouse gases into the atmosphere.

In Yukon, and across the circumpolar north, the effects of climate change are becoming more apparent and better understood. Yukon is experiencing impacts such as thawing permafrost, increased glacial melting, rising sea levels on the north coast, beetle infestations across southern spruce forests and more extreme weather events. These climate change impacts are threatening the structural integrity of buildings, highway infrastructure, are impacting traditional ways of life, damaging heritage sites and increasing the risks, costs and impacts of forest fires.

Recent analyses of the impacts of climate change, including the comprehensive *Arctic Climate Impact Assessment Report*, have increased the knowledge base and understanding of climate change in the north. It is now known that the average temperatures in the Arctic have risen at almost double the global rate in the past few decades and that this trend is expected to continue. Climate models project that over the next century, temperatures could rise by three to five degrees Celsius over land and up to seven degrees Celsius over the oceans. Levels of precipitation are also expected to increase in Yukon due to climate change, with more precipitation expected in the winter verses the summer.

Climate change impacts are being researched and investigated through a broad range of disciplines, including the consideration and application of both scientific and traditional knowledge. The Yukon government acknowledges that Traditional Knowledge is of critical importance in fully understanding climate change impacts and adaptation strategies.

This increased understanding and awareness of the impacts of climate change in Yukon is highlighting the need for a coordinated response. The Government of Yukon Climate Change Strategy sets out the government's role and key goals for its response to climate change. The Climate Change Strategy includes broad goals targeted at enhancing the awareness and understanding of climate change impacts, taking measures to reduce the levels of greenhouse gas emissions in Yukon, building environmental, social and economic systems that are able to adapt to climate change impacts and positioning Yukon as a northern leader for applied climate change research and innovation.

The Yukon government will pursue the implementation of its Climate Change Strategy in partnership and collaboration with First Nation governments, municipalities, industry, the public, the other northern territories and the provinces, the federal government and other governments around the world. It is prudent for the Yukon government to join with others to take action on climate change and to ensure that climate change in the north is an issue that is addressed effectively.

Large landslide that developed on a hillside 15 km southeast of Carmacks and travelled downstream over 4 km in a highly destructive debris flow, nearly blocking the North Klondike Highway.

Yukon Response to Climate Change

Human responses to climate change are classified as one of two general types, mitigation and adaptation.

Mitigation responses attempt to reduce the volume of greenhouse gases discharged into the atmosphere to stabilize concentrations of greenhouse gases in the atmosphere. Some mitigation measures include:[1]

- increasing energy efficiency;
- shifting from high carbon to low carbon fuels;
- increasing use of renewable energy sources (solar, biomass, wind); and
- investigating carbon sequestration in vegetation and soils.

Adaptation measures are intended to reduce vulnerability and damage from the bio-physical and socio-economic impacts of climate change. Adaptation measures can be implemented on a sector-by-sector basis, by locality or by type of climate hazard. Some adaptation measures include:[1]

- risk sharing via insurance or disaster relief;
- event modification (fire control, erosion);
- event prevention (dykes, controlled water releases, alternate building design);
- modified land and natural resource management (new species, timber harvesting); and
- public education and outreach.

Yukon Challenges

A variety of conditions unique to Yukon present a number of challenges in addressing climate change. The impacts from climate change on Yukon are potentially very expensive: spruce beetle infestation into merchantable timber; increasing fire suppression costs; potential for increasing incidents of invasive species; highway maintenance: infrastructure damage due to melting permafrost; winter road construction; reduced exploration season; changes to agricultural productivity and compromised subsistence hunting and fishing are all examples of costly climate change impacts. With limited financial capacity, Yukon is faced with the challenge of how to maximize the effectiveness of climate change dollars.

From a global perspective, Yukon generated greenhouse gas emissions are very low while the rate and magnitude of temperature change in the region is predicted to be one of the largest. Even if Yukon achieved zero greenhouse gas emissions, the impact on global warming would be infinitesimal. With such limited influence over global emission levels, the extent of Yukon's impacts from climate change is controlled by large global emitters.

Although Yukon generates low greenhouse gas emissions in comparison to other jurisdictions, our per capita emission rate is quite high. This is the result of the high energy input required to live long distances from production centers.

[1] *An Exploration of Potential Directions for Climate Change Policy in Northern Canada*. Winter 2001, "The Northern Review", Number 24, page 135.

Yukon Opportunities

Climate change is bringing a renewed focus on the North. This provides an opportunity for Yukon to showcase its progress and innovation on climate change. Yukon has established a strong foundation for advancing climate change impacts and adaptation research and monitoring, testing and innovation through organizations such as the Energy Solutions Centre. The anticipated impacts of climate change in Yukon holds the potential for Yukon-based adaptation research to be nationally and globally significant. On the development side, our small, northern, rural and urban population base makes Yukon an excellent site for testing various products, policies, programs and messages. Existing federal recognition of the unique challenges and potential in northern and First Nation communities signals opportunities for federal assistance in the continued development of these tools, which are essential to an effective climate change response.

Climate change may also hold opportunities for the Yukon private sector. For example locally pioneered renewable energy expertise with on-grid, off-grid and micro-grid projects, can be transplanted to other jurisdictions. Changes to the climate may also expand opportunities for agriculture and forestry.

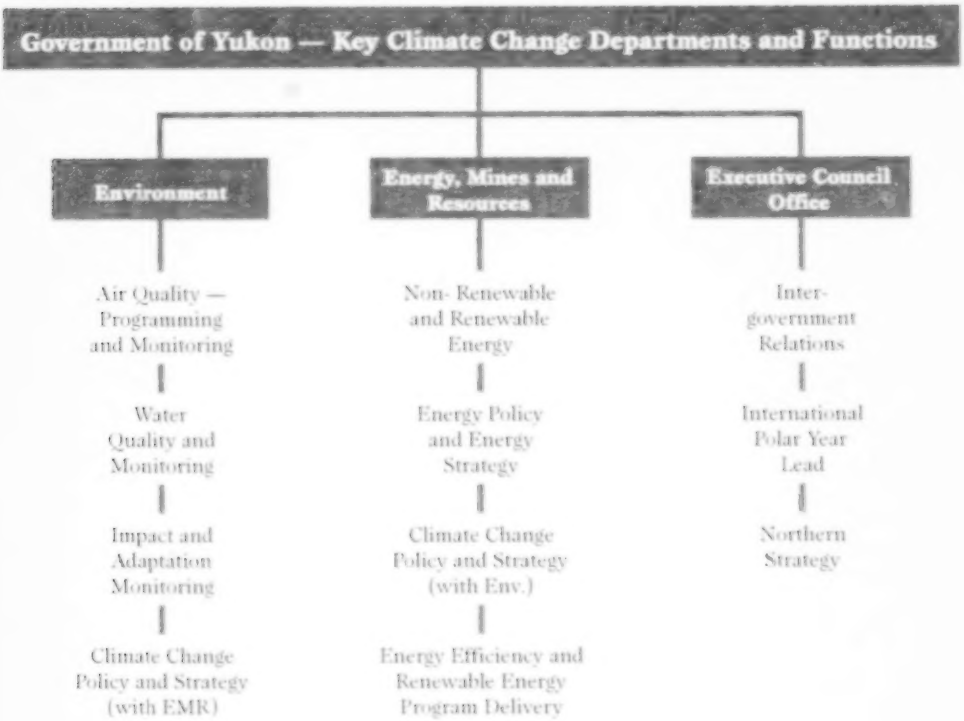
These wind turbines are located on Haeckel Hill, near Whitehorse. In the Yukon, commercial wind turbines currently provide enough electricity to displace 994 tonnes of CO_2e annually

Roles and Responsibilities

ROLE OF THE GOVERNMENT OF YUKON

Federal, provincial/territorial and municipal governments in Canada all share jurisdiction and authority in addressing climate change. In Yukon, the role of responding to climate change matters has been further distributed with the realization of self-government by a majority of the Yukon's fourteen First Nations.

The responsibilities for addressing climate change are clearly shared and there are partnerships with all levels of government and collaboration with NGO's and other interested parties that will be affirmed and established. The Yukon government can, however, demonstrate leadership by defining its own climate change role. This strategy outlines the government's strategic vision, guiding principles, goals and priority strategies to address climate change.


Government of Yukon — Key Climate Change Departments and Functions
Environment
Energy, Mines and Resources
Executive Council Office
Air Quality — Programming and Monitoring
Water Quality and Monitoring
Impact and Adaptation Monitoring
Climate Change Policy and Strategy (with EMR)
Non- Renewable and Renewable Energy
Energy Policy and Energy Strategy
Climate Change Policy and Strategy (with Env.)
Energy Efficiency and Renewable Energy Program Delivery
Inter-government Relations
International Polar Year Lead
Northern Strategy

The Government of Yukon Climate Change Strategy

APPROACH

The Government of Yukon Climate Change Strategy is the initial step in developing a strategic approach to addressing climate change. The strategy is specific to internal government operations and outlines how the Yukon government will build on a foundation of experience and expertise in managing climate change. This strategy will be followed by a comprehensive and detailed action plan that will outline the specific actions and initiatives that the government will undertake to implement the strategy. The action plan will benefit from broad public consultation to ensure the plan is relevant to Yukoners.

As climate change is a rapidly evolving issue, both scientifically and politically, the Yukon government commits to a full review and revision of its Climate Change Strategy and Action Plan within two years of release and, at a minimum, every five years following.

The government also intends to develop and release a comprehensive energy plan, which will outline measures on the supply and demand management side of Yukon's energy resources and will have a strong linkage to the Climate Change Strategy and Action Plan.

STRATEGIC VISION

A northern region enabled to minimize the negative bio-physical and socio-economic impacts of climate change, committed to reducing greenhouse gas emissions, and positioned to harness new opportunities presented by climate change.

GUIDING PRINCIPLES

The Yukon government will demonstrate climate change leadership and will:

1. Concentrate on Opportunities and Challenges:
    - Focus actions by concentrating efforts on challenges and opportunities inherent to our rural northern jurisdiction.
2. Build on Strengths and Successes
    - Build on Yukon's demonstrated strengths and successes in the areas of public education and outreach, northern impacts and adaptations research, energy efficient building science, integrated household energy solutions and applied northern renewable energy research.
    - Continue to support the investigation of climate change impacts through scientific and traditional means including the research and monitoring of water resources, habitat, fisheries and wildlife.
3. Work in Partnership
    - Pursue partnerships with other governments, institutions and the private sector to leverage opportunities and address common challenges with respect to climate change.

GOALS

1. Enhance awareness and understanding of climate change impacts on Yukon's environment, people and economy.
2. Reduce greenhouse gas emissions in Yukon through efficiency improvements in the short term and additional measures related to infrastructure replacement in the longer term.
3. Build Yukon environmental, social and economic systems able to adapt to climate change impacts and positioned to take advantage of opportunities presented by climate change.
4. Support efforts to establish Yukon as a northern leader for applied climate change research and innovation.

PRIORITY STRATEGIES

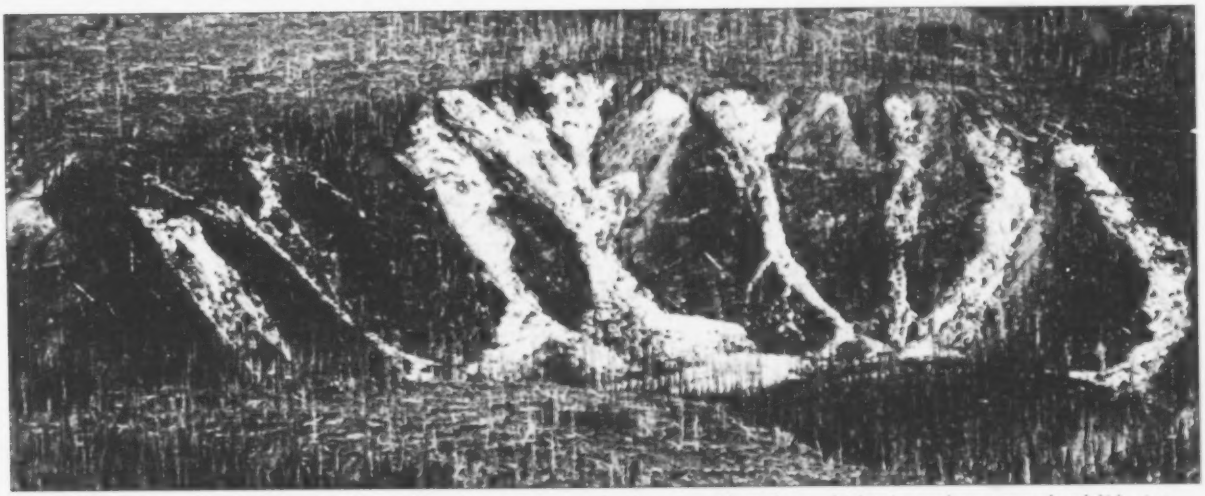
Goal One	Priority Strategies
Enhance awareness and understanding of climate change impacts on Yukon's environment, people and economy.	• Foster the creation, collection and dissemination of Yukon-specific climate change information. • Apply the scientific and traditional knowledge of impacts and adaptation research in the north for the use and benefit of northerners and for application in future development. • Continue research and educational programs based on needs assessments performed in Yukon for Yukon, such as the Northern Climate ExChange's *Gap Analysis Project*. • Continue to develop and refine climate change related databases ensuring ease of access and availability of information relevant to Yukon and the north. • Support major climate change impact projects, including the Arctic Council's *Arctic Climate Impact Assessment* project.

The Spruce Bark Beetle has affected 380,000 hectares of boreal forest in the Alsek River corridor in Kulane National Park and in the Shakwak Valley north of Haines Junction.

Goal Two	Priority Strategies
Reduce greenhouse gas emissions in Yukon through efficiency improvements in the short term and with infrastructure replacement in the longer term.	• Continue to look at alternatives to diesel for electricity generation. • Continue and maintain an energy consumption database to provide baseline data on electricity and heating fuel consumption for Yukon government buildings and on transportation emissions for Yukon government vehicles. • Work with the Federal government to ensure that greenhouse gas reporting mechanisms are simple, effective and accurately reflect Yukon emission levels. • Enhance the Yukon government purchasing policy to encourage procurement of low-emission goods and services. • Establish energy performance standards for Yukon government new building construction and renovations which meet or exceed R2000 standards for residential construction and LEED certified standards for commercial and institutional construction. • Institute energy efficiency measures for the Yukon Government vehicle fleet. • Implement a comprehensive energy conservation program for existing buildings to meet or exceed the standards proposed by the Canada Green Building Council.

Goal Three	Priority Strategies
Build Yukon environmental, social and economic systems able to adapt to climate change impacts and positioned to take advantage of opportunities presented by climate change.	• Work to incorporate climate change mitigation and adaptation measures into environmental assessment practices with the Yukon Environmental and Socio-economic Assessment Board. • Support the design and implementation of northern-appropriate energy conservation measures and integrated energy efficiency solutions for application in all sectors of the Yukon economy. • Assess and prioritize climate change-related technology and innovation gaps and opportunities. • Continue to work will all levels of government on comprehensive adaptive strategies.

Goal Four	Priority Strategies
Support efforts to establish Yukon as a northern leader for applied climate change research and innovation.	• Support developments to address climate change challenges through energy efficiency, alternative energy resource and technology development. • Support development of scientific research of permafrost condition/degradation in Yukon. • Build capacity in academic and research facilities. • Cooperate with other northern jurisdictions on climate change initiatives. • Make innovative use of the current Whitehorse-Aishihik-Faro electricity grid over-supply. • Continue research and monitoring programs in conjunction with major climate change impact projects such as the *Arctic Climate Impact Assessment*. • Continue to support the acquisition of knowledge on climate change projects through the International Polar Year of 2007–2008 and 2008–2009. • Support the development and continuation of research and innovation centers in Yukon including the Northern Climate ExChange and the Yukon Cold Climate Innovation Cluster.



Marshall Creek, just east of Haines Junction. Forest fires in the area lead to permafrost thaw which triggered numerous landslides into a small drainage basin. Similar activity has recently been noted in other parts of the Yukon after forest fires (particularly Dawson City after the 2004 fires). More of this type of activity can be expected if the number and severity of forest fires increases with climate change as has been predicted.

The Science of Climate Change

The *Arctic Climate Impact Assessment* report represents the most current and comprehensive study of the impacts of climate change on the north. This assessment is a snapshot in time, amalgamating the results of work from over three hundred scientists around the circumpolar north. Published in 2004 by the International Arctic Science Committee and sponsored by the Arctic Council's eight government members and six participating indigenous peoples' organizations, this assessment has increased the knowledge base and understanding of climate change in the north. Scientific research however is ongoing and advancing significantly, quickly dating large reports of this manner.

Some key findings stated in the *Highlights* document, which accompanies the full report, include:[2]

- **Rising Arctic Temperatures:** Records of increasing temperatures, melting glaciers, reductions in extent and thickness of sea ice, thawing permafrost and rising sea level all provide strong evidence of recent warming in the Arctic. In Alaska and western Canada, winter temperatures have increased as much as three to four degrees Celsius in the past 50 years. Over the next 100 years annual average temperatures are projected to rise three to five degrees over land and up to seven degrees over the oceans.
- **Declining Sea Ice:** Over the past 30 years, the annual average extent of sea-ice has decreased by about eight per cent, or nearly one million square kilometers, an area larger than all of Norway, Sweden and Denmark combined, and the melting trend is accelerating.
- **Thawing Permafrost:** Transportation and industry on land, including oil and gas extraction and forestry, will increasingly be disrupted by the shortening of the periods during which ice roads and tundra are frozen sufficiently to permit travel. The number of days in which oil exploration activities on the tundra that are allowed under Alaska Department of Natural Resources standards has been halved over the past 30 years due to climate warming.
- **Shifting Vegetation Zones:** Climate change is projected to cause vegetation shifts because rising temperatures favour taller, denser vegetation, and will thus promote the expansion of forests into the arctic tundra, and tundra into the polar deserts. These vegetation changes, along with rising sea levels, are projected to shrink tundra area to its lowest extent in the past 21,000 years, greatly reducing the breeding area for many birds and grazing areas for land animals that depend on the open landscape of tundra and polar desert habitats. Not only are some threatened species very likely to become extinct, some currently widespread species are projected to decline sharply.
- **Increasing Fires and Insect Outbreaks:** Forest fires, insect infestations, and other disturbances are projected to continue to increase in frequency and intensity in a warming climate. Since an outbreak was first identified in 1994, the spruce bark beetle has affected 380,000 hectares of boreal forest in the Alsek River corridor in Kluane National Park and in the Shakwak Valley north of Haines Junction. This is the largest and most intense outbreak of spruce bark beetle ever to affect Canadian trees.

[2] *ACIA*, 2005. Arctic Climate Impact Assessment. Cambridge University Press.

In Yukon, the Northern Climate ExChange, part of the Northern Research Institute at Yukon College, has the mandate to provide a credible independent source of information on climate change in northern Canada. Data collected in the Yukon by this agency is consistent with global data that indicates "the rate and magnitude of temperature change will be greatest in high latitude regions of the Northern Hemisphere, and may rise by as much as five to seven degrees Celsius".[1]

Projections of Yukon-specific climate changes include:

- Higher average temperatures year-round with:
  - Winters warming more than summers, winter warming being greater farther north; and
  - Summers warming more in the south and central Yukon than in the north, due to the moderating effect of the Beaufort Sea.
- More snow in the winter, with the change being greater farther north. It is expected that there will be little change in average summer precipitation levels.
- More and larger storm events, both winter storms and heavy summer rainfall storms, with more thunder and lightning.

[1] *Measuring the Past*, undated, Bulletin No. 2, Northern Climate ExChange, page 1.

Subsidence of road fill along the Alaska Highway near Beaver Creek caused by permafrost thaw beneath fill. The failure is not directly linked to climate change — rather it was caused by disturbance of groundwater flow pathways which has lead to permafrost thaw at this site. But it is representative of the type of failures that could occur along highways as permafrost starts to thaw more.

YUKON CLIMATE CHANGE IMPACTS

Climate change impacts are classified as being one of two general types. The first, bio-physical impacts include physical changes to northern landscapes and ecosystems. The second type of impact, socio-economic, derives from bio-physical impacts and is expected to change how all Yukoners live and work. These impacts have been outlined in the 2004 *Arctic Climate Impact Assessment*.[1]

Bio-physical Impacts

Glaciers: In areas of high snowfall increased snowfall is expected to compensate for increased warming due to warmer summer temperatures and glaciers that are advancing will continue to do so. Some glaciers at lower elevations may start to retreat, or retreat at a greater rate. Increased land instability is expected to result from glacial retreat, with increased debris flows and changes in stream flow.

Permafrost: Permafrost exists across most of the Yukon: as continuous permafrost north of the Arctic Circle, discontinuous permafrost in central Yukon, and sporadic permafrost in the south of the territory. Climate change is expected to affect permafrost by increasing the depth of the active layer and by generally shifting the zones northward by several hundred kilometers by the end of this century. The greatest change is expected in the discontinuous permafrost zone.

Land stability: Occurrences of landslides, including thaw-flow slides, are expected to increase due to melting permafrost and increased glacial runoff, the impacts of which could be amplified by the expected increase in forest fire activity.

Water resources: The hydrology in the North is particularly susceptible to warming, since even small increases in temperature increase the melting of snow and ice which can disrupt the distribution and circulation of water in the region. Increased ponding of water is possible in some areas while in others peatlands may dry out. Infiltration may be affected in some areas where permafrost thaws. Impacts will be regionalized with some areas experiencing water shortages while others experience flooding.

Habitat: Habitats are predicted to shift northwards in latitude and upwards in elevation. For example, it is predicted that the tree line will move up mountainsides and northward. This means a loss of some types of habitat and gains in others, such as more forest and less tundra. A decline in wetlands, especially bogs, is expected. As habitat ranges shift so will species, this will be an advantage for some species and put others at risk. Those species most at risk are those that live at the edge of their range, have very stringent habitat requirements, do not easily move into new areas, or adapt less rapidly to changing conditions.

Land ecosystems: White spruce and lodge pole pine are expected to dominate in Yukon forests at the expense of black spruce. In alpine and tundra areas, seasonal plants may come to be dominated by larger shrubs. Plant species previously found only to the south are expected to make their way into the Yukon.

[1] *ACIA*, 2005. Arctic Climate Impact Assessment. Cambridge University Press.

Wildlife: Long term changes in snowfall, and changes in the timing of spring, are predicted to alter the distribution and abundance of ungulates (e.g. moose, caribou, and deer). More snow restricts the movement of ungulates in winter, and reproductive success is often linked to snow patterns and availability of food during the calving season. Insect-borne disease, parasites and more insect harassment may cause caribou and other animal populations to decline. It is also expected that changes to historical snow fall and precipitation trends will have varying impacts from prey to predator species (mice to wolves).

Birds: A warmer climate may decrease chick mortality through longer nesting seasons and improved food availability. Migrating birds may experience a decrease in foraging ability as a result of delayed spring thaws. The habitat range of bird species may shift while the climate changes.

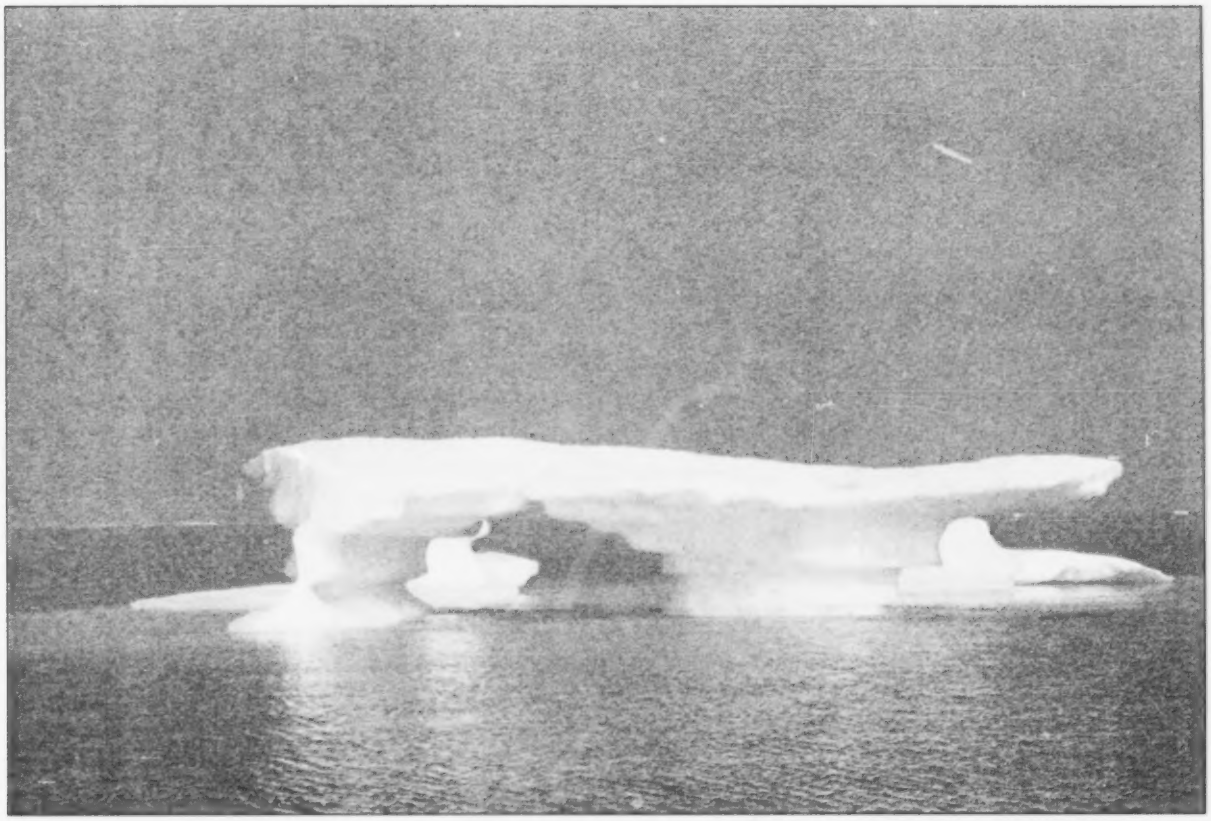
Freshwater ecosystems: A warmer climate may bring increased productivity to northern lakes and rivers for some species of fish, while cold water species would suffer. The warming may also cause deterioration in fish habitats through changes in water flow and water quality, and the introduction of new parasites. Landslides may result in increased sediment loads, and melting ice can release organic material into streams, which reduces the oxygen supply for fish.

Marine ecosystems: Earlier ice break-ups could disadvantage animals that depend on sea ice such as walrus, polar bears and seals. Sea ice platforms used by walrus, polar bears and some seals for breeding, nursing pups, hunting, resting and molting may also be lost.

Yukoners are concerned about the impact climate change will have on caribou populations. Due to climate change caribou may shift migration patterns, suffer increased pest disturbance or suffer higher mortality rates.

Sea level: The sea along Yukon's coast has been observed to be rising at an abnormally high rate and could rise more depending on the effects of a warming climate on major ice sheets in Greenland and Antarctica.

Coastal zones: The Yukon coast will experience increased erosion and flooding, which may result in loss of wetlands, increased risk to building and infrastructure as well as critical habitat loss for many species. This will occur as a result of more frequent and severe summer storms, sea level rise combined with melting ice-rich permafrost, and changes in sea ice.



Warmer temperatures will increase glacier melting. This could impact land stability through increased erosion or fish habitat by increased sediment load in water courses.

Socio-economic Impacts

Tourism and culture: Longer and warmer summers could enable an increase in tourism visitation, while shorter winters may limit winter visitation. Erratic winter weather conditions could negatively impact the Yukon film production industry's "first and last" snow marketing potential.

Community infrastructure: Melting of permafrost could negatively impact the structural integrity of water and sewer systems, buildings, pipelines, culverts and storage tanks. Water courses may change and create a need to relocate and/or improve infrastructure. Changing precipitation levels could necessitate redesign and upgrades to dams and water diversion structures.

Hydroelectric production: Changes in glacial melt patterns and precipitation rates could alter stream flows and impact the generation of electricity from hydro sources.

Transportation infrastructure: Transportation infrastructure (roads, airstrips, bridges) which relies on the properties of frozen ground may be negatively affected and make the transportation of goods and services into Yukon communities and mining operations more difficult. For example, the length of use of winter roads, which provide access to exploration sites and remote communities, could be reduced if frost-free periods increase in length.

Forestry: Warmer temperatures may reduce the number of years Yukon forests need to grow to reach maturity and improve industry potential. At the same time, increased forest fire frequency and severity is anticipated as is an increase in damage-causing forest insect pests.

Agriculture: Subject to soil conditions and future precipitation patterns, warmer Yukon summers may lengthen the growing season, improve yields and allow a wider variety of crops to be grown and enhance greenhouse production.

Renewable resources: Changes in the location and populations of species will affect the nature and availability of hunting, trapping and fishing activities.

Traditional lifestyle: Impacts of climate change on the distribution and abundance of key fish and wildlife resources will affect the economy and culture of people living a traditional lifestyle.

Health: The floods, droughts, and strong wind events predicted to result from climate change have the potential to threaten people's lives and livelihoods. The spread of vector-borne diseases such as the West Nile virus, assisted by warming temperatures, also pose a threat to human health.

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